

Enhancing Numeracy Skills of Grade 3 Students Through Authentic Performance Tasks

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Abstract: Numeracy is the capacity to use mathematical ideas in all facets of life. It involves activities such as adding and subtracting numbers, counting, number recognition, solving number problems involving various operations, sorting, observing, identifying, and establishing patterns. It is one of the fundamental skills that students should have mastered by the end of their primary schooling. With the notable importance of mastery of numeracy skills, low achievement and performance of the learners were observed in this aspect. This study aimed in enhancing the numeracy skills of Grade 3 learners through authentic performance tasks. The variable in numeracy skills includes the four fundamental operations and problem solving. The quasi-experimental design was utilized wherein purposive sampling or non-randomized sampling was used. In this study, 33 Grade 3 learners of Rizal Elementary School were selected to participate in the tests. Pre-test and post-test crafted by the teacher were the main instrument in the study. The result revealed that in the pre-test the learners obtained a mean percentage score (MPS) of 38.20% in four fundamental operations, which implied a non-numerate level. While in terms of problem solving, the learners obtained a MPS of 20.60% which is also in the non-numerate level. It has a grand mean of 29.40% with an interpretation of non-numerate level. In the post-test, it was observed that four fundamental operations have a MPS of 81.10% which is in average numerate level, while problem solving has a MPS of 76.30% with a grand mean of 78.70% with an interpretation of average numerate level. This implied that there is a significant difference between the pre-test and post-test in the four fundamental operations and problem solving. Thus, it can be concluded that the application of authentic performance tasks was effective to bridge the gap on numeracy skills.

Keywords: Numeracy skills; Authentic performance tasks; Four fundamental operations; Problem solving; Grade 3 learners

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1. Introduction

Numeracy is the capacity to use mathematical ideas in all facets of life. It involves activities such as adding and subtracting numbers, counting, number recognition, solving number problems involving various operations, sorting, observing, identifying, and establishing patterns. It is one of the fundamental skills that students should have mastered by the end of their primary schooling. It is just as crucial as being proficient in reading and writing because it is a fundamental skill for both future employment and daily life. With such skills, the learners

will strive on mastering other complex mathematical skills. For this reason, these skills must be honed at an earlier age.

Early math and numeracy skills serve as the cornerstone for all subsequent math studies. One of the key early math skills that students must acquire is how to solve issues in all facets of academics and life outside of school. The skills on the four fundamental operations are crucial for other mathematical skills. Moreover, problem solving is also a required skill in Mathematics. Without these skills, students will continue to have difficulty with more advanced mathematical topics. There has been an issue in establishing a high level of numeracy skills as revealed by international tests.

According to the Trends in International Mathematics and Science Study (TIMSS) 2019 ^[1], Filipino students fell behind other countries in the international assessment for Mathematics. The country scored 297 points which appeared to be the lowest among the 58 participating countries. In another assessment conducted by Program for International Student Assessment (PISA) in 2018, the Philippines placed second to the lowest in Mathematics among 79 participating countries. This was validated by the statement of the Department of Education that they expected the outcome of the said assessment because learners were also not performing well in the National Achievement Test.

Nelson and McMaster ^[2] found out that students who suffer in their first years of schooling with arithmetic and numeracy continue to struggle in later years, which may account for the students' poor performance on numeracy tests in later years of school. One of the key concerns of teachers who want to improve the academic performance of their students is the development of numeracy skills. Without a question, teachers and parents play a significant role in laying the groundwork for a strong foundation in learning so that children have the right tools for the job. They have a responsibility to make sure that learning continues and that no students fall behind. They should consider and provide a range of solutions on how to keep studying and improve learners' numeracy skills despite the difficulties in our educational system. This is the proof of the importance in enhancing the numeracy skills that are the basis of basic school.

In regard to this, it was observed that the numeracy skills of Grade 3 students in Rizal Elementary School should be enhanced and developed. This can be seen in the result of the quarterly examination in recent years wherein it appeared that Mathematics is one of the subjects that is the least mastered by learners. Based on the gathered data of quarterly examination in the previous school year, the attained mean percentage score (MPS) for the first quarter was 76.20 and 71.02 for the second quarter, which is the lowest among all the Grade 3 subjects. The same scenario happens even today. Based on this, the learners should be given more attention and enrichment or remediation in this subject. This is the main reason of conducting the study of applying authentic performance tasks or assessments in education to enhance the numeracy skills of learners at this time and observe the effects of authentic performance on learners in addressing the learning gaps in terms of numeracy.

2. Literature review

Aunio *et al.* ^[3] investigated whether an intervention program could improve early numeracy in South African first graders at risk of mathematics learning difficulties. The participants were 267 children from 17 classrooms in Greater Johannesburg. In this small-group, quasi-experimental intervention study (15 sessions over 5 weeks), the outcome measure was early computational skills. Based on initial pre-test numeracy scores, children were divided into an intervention group ($n = 40$), a low-performance control group ($n = 32$), and an average-performance control group ($n = 195$). The main finding was that the numerical relational skills of the intervention group were more improved compared to the weak control group. This effect remained statistically significant after adjusting for administrative function, language skills, and kindergarten attendance, and

was also observed in follow-up delay measures. Executive function, language proficiency, and kindergarten attendance all predicted levels of early numeracy skills at the start of the intervention, but only executive function demonstrated individual differences in the development of numeracy skills before and after the test.

Intervention for mathematics difficulties has been one of the top priorities for researchers and the education department due to persistent low mathematics achievement. Many researchers came up with various interventions and projects to improve students' performance in numeracy. The Department of Education even allocated budget to reinforce its initiatives to equip learners with fundamental literacy and numeracy skills through Early Language, Literacy, and Numeracy (ELLN) program. (DepEd Order no. 12, s. 2015). This aims to develop learners' literacy and numeracy skills and attitudes which will contribute to lifelong learning.^[4]

Siagan *et al.*^[5] conducted a study to analyze the effectiveness of learning materials oriented to problem-based learning models in improving students' mathematical problem solving and metacognitive skills. The learning materials developed include lesson plans, student books, student worksheets, mathematics problem solving skills, and student metacognitive tests. Expertly validated learning materials were tested in Class VII of SMP Negeri 13 Medan (Grade 7). Results showed that learning materials aimed at problem-based learning met the criteria for effectiveness and improved mathematical problem solving skills and metacognition. Students' metacognition improves as problem solving reaches levels of strategic, conscious, and implicit use.

Word problems are one of the most difficult problems faced by mathematics learners. Perhaps that is the reason it has been the subject of extensive research over the last 50 years. The strengths and weaknesses of informal and formal solution strategies at different levels of learner mathematical development (arithmetic, algebra, etc.) are discussed. Word problems are exercises for solving complex problems that require the use of cognitive (heuristic) and metacognitive (or self-regulatory) strategies. The complex and sometimes surprising results of expression studies (both self-produced and externally provided) are summarized and discussed. Similar to many other areas of mathematics learning, the ability to solve word problems has been shown to be highly related to a range of general cognitive resources, such as working memory capacity and inhibition skills. Moreover, this research finds a gap between the artificial writing problems of learners in math lessons and the authentic math modeling situations faced by learners in real life^[6].

Tallud and Caballes^[7] mentioned that the primary learners showed low performance in terms of numeracy skills. After eight weeks of intervention program, it was shown that there was no significant difference on their numeracy skills. This implies a need to revisit intervention programs. Schools may apply other strategies to ensure the attainment of better numeracy skills of learners. Drills may be done, materials may be revised, and activities that cater to individual differences may be considered.

3. Research objectives

The study aims to determine the effects of authentic performance task on enhancing the numeracy skills of Grade 3 students. Specifically, it sought to attain the following objectives:

- (1) To determine the pre-test performance of learners in terms of four fundamental operations and problem solving.
- (2) To ascertain the post-test performance of learners in terms of four fundamental operations and problem solving in reference to the pre-test performance.
- (3) To compare the result of the pre-test and post-test of the Grade 3 learners.

4. Research method and procedures

4.1. Research design

The proposed design used was the quasi-experimental design. In this design, a pretest was employed for Grade 3 learners without the application of the authentic performance tasks. After analyzing the tabulated result, an intervention was implemented to see if there were changes in the performance of the learners when compared to before the post-test.

4.2. Respondents and sampling

The population of the study involved one of the sections of Grade 3 students in Rizal Elementary School who are currently enrolled for the school year 2022–2023. The section of Grade 3 Gabriela Silang with 33 learners were the participants of this study.

4.3. Assessment tools

Pre-test and post-test, of similar content, were crafted by the teacher to measure the performance of the learners with the application of the authentic performance tasks.

During Mathematics class, varied authentic performance tasks were introduced to learners for the topics of four fundamental operations and problem solving which were the most difficult areas for the learners in Mathematics subject.

4.4. Data collection

The approval of the School Head of Rizal Elementary School was obtained, by sending a letter of request for conducting the study under the School Division Office (SDO) of Lipa City. After securing the approval of the school head, the test was crafted which was evaluated by the public school's district supervisor in the elementary level. Then, pre-test was administered to the respondents of the study. The result served as the baseline if there was a positive outcome from the intervention. Subsequently, a series of intervention were done during Mathematics class. Then, the post-test was administered, with the same content as the pre-test. This determined whether the students learned significantly upon the application of the authentic performance tasks. Lastly, the scores were tabulated.

4.5. Data analysis

The following were the statistical treatment that were used in the study. Mean was used to get the average of the scores of the Grade 3 learners during the pre-test and post-test. Paired *t*-test was used to determine the significant difference of the result in the pre-test and post-test results. The following scale was used to score the responses: 85–100% is interpreted as highly and above numerate, 75–84% is average numerate, 65–74% is emergent, and 64% and below is non-numerate.

4.6. Ethical considerations

Full consent from the school head was obtained prior to conducting the study, by providing a letter upon conducting the study. Furthermore, the confidentiality of the name of the learners who participated in the pre-test and post-test was secured.

5. Results and discussion

This section presents the findings of the study, the discussion, and its implications. The statement of the problem and the corresponding discussion are given.

5.1. Pre-test performance of learners in terms of four fundamental operations and problem solving

The numeracy skills of the Grade 3 students were assessed before the application of the authentic performance task. Two areas include the four fundamental operations and problem solving were assessed. The mean score and percentage with respect to the total number of items in the pre-test performance of learners are presented in **Table 1**.

Table 1. Pre-test performance of learners

Area	Mean	MPS	Interpretation
Four fundamental operations	3.82	38.20%	Non-numerate
a. Addition	5.48	54.80%	Non-numerate
b. Subtraction	4.21	42.10%	Non-numerate
c. Multiplication	3.21	32.10%	Non-numerate
d. Division	2.36	23.60%	Non-numerate
Problem solving	2.06	20.60%	Non-numerate
a. Addition	2.70	27.00%	Non-numerate
b. Subtraction	2.12	21.20%	Non-numerate
c. Multiplication	1.88	18.80%	Non-numerate
d. Division	1.55	15.50%	Non-numerate
Grand mean	2.94	29.40%	Non-numerate

Based on the table, it reveals that the learners were generally non-numerate. In terms of the four fundamental operations, the learners were identified as non-numerate in all aspects such as addition, subtraction, multiplication, and division. In problem solving, the learners were considered as non-numerate. This means that the learners have a hard time dealing with fundamental operations as well as problem solving. This is an alarming issue among teachers.

The result implies that the learners have a low level of numeracy skills. This may be attributed to the limited guidance provided by teachers due to the years spent on remote learning. The formative years need sufficient guidance to be able to uphold numeracy skills. This further implies that the learners have difficulty in understanding fundamental operations and problem solving. This also reflects a higher score on fundamental operations than problem solving as the latter required complex understanding on the part of the learners.

In relation to this, low early numeracy achievement may also be a sign of future mathematical learning difficulties. Poor counting skills such as reciting numbers word sequence, weak numerical relational skills, and weak basic arithmetic skills can be observed during children's daily classroom activities most especially if the children are not given proper attention when it comes to numeracy. Mathematical skills are important, not only for school performance, but also for children's future educational attainment ^[8].

5.2. Post-test performance of learners in terms of four fundamental operations and problem solving

After the implementation of the authentic performance task, the students were tested again to verify the effectiveness of the intervention. The results were gathered to identify whether the application of authentic performance tasks can help to improve the numeracy skills of learners. **Table 2** presents the post-test performance of learners.

Table 2. Post-test performance of learners

Area	Mean	MPS	Interpretation
Four fundamental operations	8.11	81.10%	Average numerate
a. Addition	8.97	89.70%	Above average
b. Subtraction	8.64	86.40%	Above average
c. Multiplication	7.48	74.80%	Average numerate
d. Division	7.33	73.30%	Emergent
Problem solving	7.63	76.30%	Average numerate
a. Addition	8.49	84.90%	Average numerate
b. Subtraction	8.09	80.90%	Average numerate
c. Multiplication	7.09	70.90%	Emergent
d. Division	6.85	68.50%	Emergent
Grand mean	7.87	78.70%	Average numerate

It reveals that the learners generally became average numerate after the implementation of authentic performance tasks. In terms of the four fundamental operations, the learners fell in the average numerate level. It can be seen that the learners had above average level in terms of addition and subtraction. Moreover, learners attained an average numerate level in terms of multiplication. Lastly, the learners fell in the emergent level in terms of division, thus the learners require further enhancement in terms of division.

In terms of problem solving, the learners were identified as average numerate. Both in the addition and subtraction area, the learners attained an average numerate level. On the other hand, the learners fell in the emergent level in terms of multiplication and division. This means that the learners must strive for enhancement in terms of problems involving multiplication and division.

The result implies an increase in the numeracy skills of learners. This result is attributed to the effectiveness of the application of authentic performance task in class instruction. The learners need supervised and meaningful tasks that will nurture their skills. The result further implies that the presence of tasks to which they can relate well contributes to the increase in students' level of numeracy skills. It is then the responsibility of the teacher to provide authentic learning experiences among students.

In relation to this, explicit teaching with sequenced instruction in some order (often from simple to difficult) and a strong emphasis on subject matter, led to improved mathematical learning results, according to reviews. Several of these intervention programs with small groups of children were effective (Bryant, Bryant, Gersten, Scammacca, & Chavez, 2008; Mononen & Aunio, 2014).

5.3. Comparison of the result of the pre-test and post-test of Grade 3 learners

To further verify the effectiveness of authentic performance task, statistical treatment is done. Comparing the result of the pre-test and post-test will show whether the task creates an impact on the numeracy skills of learners. This will give an idea of whether this authentic performance task may be considered as a practice to improve numeracy skills. **Table 3** shows the comparison of the pre-test and post-test scores in terms of the four fundamental operations and problem solving.

Table 3. Comparison of pre-test and post-test

Topic	Computed value	<i>P</i> value	Decision on H_0	Interpretation
Four fundamental operations	-15.624	0.000	Reject	Significant
Problem solving	-15.937	0.000	Reject	Significant

The result reveals that in terms of four fundamental operations, the *P* value is 0.000 which is less than the alpha level of 0.05. Therefore, the null hypothesis is rejected. There is a significant difference in the pre-test and post-test scores of the learners. In terms of problem solving, the *P* value is 0.000 which is less than 0.05. Therefore, the null hypothesis is rejected. There is a significant difference in the pre-test and post-test scores.

The result implies that the utilization of authentic performance tasks is effective in improving the numeracy skills of students. The use of scenarios that are true to life and experienced by learners stirs interest and facilitates learning. Authentic performance tasks create more opportunities for learning. The result further implies that the reason behind the poor numeracy skills is the limited guidance on teacher-aided tasks which is resolved in this intervention.

In relation to this, according to authors ^[3], interventions based on research evidence can alleviate the challenges of students at risk for mathematical learning difficulties. Researchers found out that there are many studies that reported positive effects of intervention for students with learning difficulties in mathematics, with only few of them focused on young learners.

6. Conclusion and recommendations

6.1. Conclusion

This study focuses on the numeracy skills of learners before and after the application of authentic performance tasks. Moreover, the significant difference in pre-test and post-test scores can tell whether the intervention was effective or not. This section presents the conclusion made based on the objectives of this study.

- (1) The level of numeracy skills of learners is very low and alarming.
- (2) The numeracy skills of learners improved after the application of authentic performance tasks.
- (3) Authentic performance tasks show effectiveness to bridge the gap on numeracy skills.
- (4) Providing real-life scenarios on instruction may affect the achievement of students.

6.2. Recommendations

This section presents the recommendations which can help to address the issue of low numeracy skills of learners.

- (1) Schools may devise programs on improving the numeracy skills of learners.
- (2) Teachers may consider the application of authentic learning tasks on their instruction to improve numeracy skills of learners.

- (3) Students may process numeracy tasks through seeking connection from real-life problems.
- (4) Future researchers may conduct similar studies to validate the generalizability of the results of this study.

Disclosure statement

The author declares no conflict of interest.

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